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National Aeronautics and Space Administration
Goddard Space Flight Center
Contract No. NAS-5-3760

ST — SP — 10 426 NASA TT F-9913

ON SOME CHARACTERISTICS OF RADIO EMISSION SOURCES CONNECTED WITH THE ACTIVE REGIONS OF THE SUN

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14 December 1965

NASA TT F-9913
ST - SP - 10426

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Vestnik Leningradskogo Universiteta
No. 14, vyp. 4, 140-142,
Seriya Matematiki, Mekhaniki i Astronomii
LENINGRAD, 1965.

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SUMMARY

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This is a preliminary communication on some of the characteristics of radio emission sources connected with the active regions of the Sun. The present observations were conducted during low solar activity. We utilized for their processing the results of observations at IHH and Nagoya stations; they allowed to conclude that a decrease in the S-component of radiation flux is observed prio to intense radiobursts but the flux increases after the bursts, since the sources linked with sunspots are directional.

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* *

Radio emission sources above the active regions of the Sun are currently subject to intensive studies. A great number of characteristics of the sources are already known more or less reliably, but some contradictory data still exist in relation to some of them (see [1, 2]). The main issue here is the dependence of source's radio emission flux F_S on its position on the solar disk when the wavelength $\lambda < 10$ cm.

Statistical research [3 - 5] made evident the notable weakening of F_S when the emission source shifts from the center toward the limb of the disk. There exist also observations of separate sources [3, 6, 7], which confirm such a conclusion. On the other hand, certain observations on radiotelescopes with high angular resolution [8 - 10] do not show any notable dependence of F_S on the distance θ from the source to the center of the disk. At the same time the characteristic of the source, referred to above, is of particular importance for resolving the question of its emission mechanism.

* O NEKOTORYKH KHARAKTERITIKAKH ISTOCHNIKOV RADIOIZLUCHENIYA SVYAZANNYKH S AKTIVNYMI OBLASTYAMI NA SOLNTSE.

There is a possibility during the current period of solar activity decrease, of obtaining supplementary information on the character of the dependence $f(\theta)$ for solitary sources. To that effect we may utilize the routine observations of solar radio emission of [11], brought out in detail in the compilations obtained by the International Center of Data Assembly in Moscow. It is possible to select in the period under consideration those time intervals when there is an active region remaining isolated during the entire period of its shift from $\theta = 0°$ to $\theta = 90°$ and for a longer time, that is, not less than two days after that. Taking advantage of the data of optical observations [12], we succeeded in separating for 1962 and 1963 six cases satisfying the imposed requirements (group No. 36 for 1962 and groups No. 43, 46, 101 and 109 for 1963).

The group No. 109 had to be excluded from analysis on account of the great number of radiobursts at $\theta > 60°$, which gave a residual increase of F_s, strongly distorting the real value of the slowly varying emission

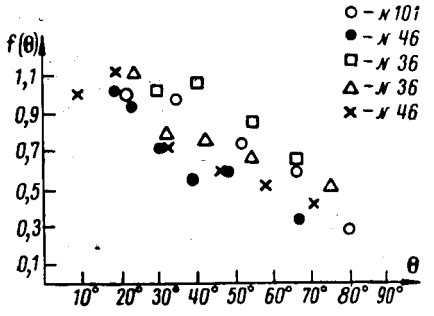

Fig. 1

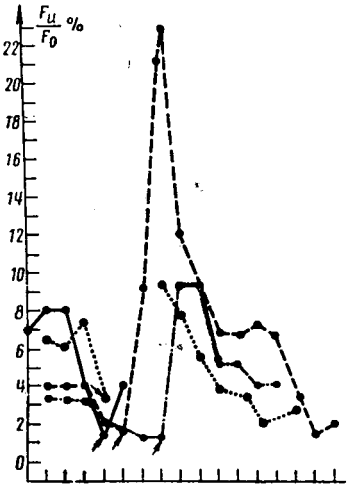

Fig. 2

Radio emission of sources above the remaining five groups was investigated as follows. Using the method of least squares and by way of extrapolation to zero of flocculus and spot areas for the given month, the level F_q of the "quiet" Sun was determined. Then, the source's emission flux $F_s = F_f - F_q$ was found by the difference between the daily integral fluxes of Sun's radio emission (F_s) and this quiet level. Dividing the flux F incident upon the spot area (S_q) for eacn day at their shift from the center to the limb, it is possible to find the dependence of source's specific emission on the angular distance θ of the spots to the center of the disk (Fig. 1). The results obtained were found to be in agreement with the data of [3 - 7, 15], but departed from the data [8 - 10].

The behavior of sources' emission flux prior to intense radiobursts constituted another characteristic of their radio emission above active regions, of particular interest for the Sun-Earth problem. It is well known that there exists a certain relationship between the characteristics of sources' slowly varying component with bursts, consisting for example in the increase of probability of burst onset either at decrease in the dimensions of the source [13], or in the variation of source's emission spectrum [14].

The dependence of the flux F_S on t at $t < t_b$ (t_b being the onset time of the burst) was difficult to find at high solar activity, when we had to separate from the aggregate flux of all sources that in whose region the burst was observed. Therefore, the relationship between F_S and t_b must be investigated only in four cases (type-C bursts). These cases are plotted in Fig. 2, from which it follows that, prior to the occurrence of the burst there is observed a clearly defined decrease in the emission flux F_S of the source. Such an effect was characteristic in all cases when the emission flux exceeded the solar flux during the burst by 1000 - 700 %. Prior to the burst the flux decreased by 2.5 - 7 % of the Sun's flux. After the burst the flux remained increased by about 10 to 20 % of the Sun's flux for some 8 - 10 hours.

It is possible that the above-presented method of forecasting intense bursts may also be applied at increased solar activity provided we separate sources are tracked by radiotelescopes with high angular resolution.

The author considers it to be its duty to express his gratitude to A. P. Molchanov and A. S. Grebinskiy for their valuable advice when discussing the results.

***** THE END *****

Contract No. NAS-5-3760
Consultants & Designers, Inc.
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Translated by ANDRE L. BRICHANT
on 13 December 1965

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